

REMARKS

Claim 1 is amended. Claims 16 and 19 are canceled without prejudice. Claims 27-31 are added. Claims 1-15, 17, 18 and 20-31 are pending in the application. The amendments to the claims and new claims do not present new matter. *See, e.g.*, Figs. 1 and 2; para. 16 (portion of the source tube extends outside of the reactor); para. 16 (portion of Ga source maintained at relatively high temperature while most of the Ga source is maintained at a temperature close to and just above the melting temperature of Ga); para. 16 (disclosing low and high temperatures), para. 37 (extended source of Ga is maintained at more than one temperature); para. 37 (portion of source tube and Ga source are maintained outside of the reactor).

Reconsideration and allowance of the application, as amended, are respectfully requested.

I. Claims Satisfy §112¶2

Claims 16 and 19 were rejected under §112¶2 and are canceled without prejudice.

Claim 1 is amended to recite “an extended gallium source partially inside and partially outside the reactor tube...” For reference, Applicants refer to sections of the subject application that describe and illustrate the structural configuration of a source tube being partially inside and partially outside a reactor. Para. 16 (portion of the source tube extends outside of the reactor); Para. 37 (source tube and Ga source are maintained outside of the reactor volume as illustrated in FIG. 1). Thus, claim 1 particularly points out and distinctly claims the structural configuration of this embodiment of the invention, and the rejection under §112¶2 is moot.

II. Claims 1-5, 7, 8, 12-14, 17, 18, 20, 24 and 25 Are Patentable Over Yanashima In View of King

Independent claim 1 and dependent claims 2-5, 7, 8, 12-14, 17, 18, 20, 24 and 25 are rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 5,993,542 to Yanashima *et al.* (“Yanashima”) in view of Great Britain Patent No. 1,218, 544 to King (“King”). Under 35 U.S.C. §103(a), to establish a *prima facie* case of obviousness of a claim, all the claim limitations must be taught or suggested by the prior art. All words in a claim must be considered in judging the patentability of that claim against the prior art. MPEP §§2143; 2143.03, citing *In re Royka*, 490 F.2d 981 (CCPA 1974). Moreover, there must be some suggestion or motivation to modify the reference, and a reasonable expectation of success. MPEP §§2143.01-2143.03; *In re Vaeck*, 947 F.2d 488

(Fed. Cir. 1991). The mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination. *In re Mills*, 916 F.2d 680 (Fed. Cir. 1990). Applicants respectfully traverse the rejection and submit that Yanashima and King cannot support the rejection given the deficiencies of the references, the lack of the required suggestion or motivation to combine the references, and that the references teach away from various claim limitations.

Applicants kindly acknowledge that the Office action admits that Yanashima fails to disclose or suggest the following limitations of claim 1:

- a) an extended gallium source at least partially in the reactor tube and within a multi-zone gallium source zone,
- b) said extended gallium source being controllably positionable
- c) so that said multi-zone heater maintains a first portion of said extended gallium source at a first temperature greater than 450°C. while simultaneously maintaining a second portion of said extended gallium source at a second temperature in the range of 30°C. to 100°C.
- d) wherein upon reaction initiation said second portion comprises at least 50 percent of said extended gallium source

Yanashima also fails to disclose or suggest the structural configuration of an extended gallium source “partially inside and partially outside the reactor tube” as recited in claim 1. *See, e.g.*, paras. 16 and 37 and Figure 1 of the subject application. In sharp contrast, Yanashima discloses an entire source being located inside a reactor tube 11. *See, e.g.*, Yanashima, Figures 2, 5 and 7. Thus, Yanashima clearly fails to disclose or suggest this limitation and actually discloses a configuration that is the opposite of that recited in claim 1.

Additionally, Yanashima fails to disclose or suggest “said extended gallium source having a length so that different portions of said extended gallium source are maintained at different temperatures” as recited in claim 1. Instead, Yanashima describes Ga material 135 in a boat 136 that is set on a plate 113.

The Office action asserts that Yanashima also discloses “a halide reaction gas source coupled to said multi-zone gallium source zone” and “an inert gas source coupled to said multi-zone gallium source zone to transport a first reaction product from said multi-zone gallium source zone to said growth zone” as recited in claim 1. However, Figure 7 (identified by the Office action) and the related description provided by Yanashima do not support the rejection. Yanashima does not

disclose or suggest a multi-zone gallium source zone. Rather, with reference to Figure 7, Yanashima illustrates and describes a reactive tube 111 “divided into five parts by partition plates 113, 114, 115 and 116.” (Yanashima, col. 11, lines 10-12). A boat 136 containing Ga 135 “is put on the partition plate 113 ... between the partition plates 113 and 114.” (Yamashima, col. 11, lines 39-42).

The Office action relies on King to fill in the many gaps of Yanashima. King, however, does not cure these deficiencies and has its own deficiencies. Further, the required suggestion or motivation to combine Yanashima and King is lacking when one considers the particular configuration and operation of the systems described by Yanashima and King.

Initially, Applicants note that the system described by King is fundamentally different compared to claim 1 since King describes a closed or sealed system (ampoule with gallium arsenide and arsenic) as opposed to a system that utilizes gas flows, as in claim 1.

Moreover, King does not disclose or suggest “an extended gallium source” as recited in claim 1. In contrast, King discloses a gallium arsenide charge 15 and an arsenic charge 16, neither of which is a gallium source nor an extended gallium source. For reference, Applicants note that the subject application describes an extended gallium source (*e.g.*, two kilograms of Ga) that provides for processing for about 80 hours. (Paras. 60 and 61). Such an extended gallium source achieves extended cycles and growth rates to allow growth of bulk crystals. (Paras. 16, 17, 20). King clearly fails to disclose or suggest an extended gallium source particularly considering King refers to a “charge,” the charge is gallium arsenide, and gallium, and a “sealed ampoule 14 of 70 cm length and 3 cm diameter.” Applicants also note that the subject application actually distinguishes an extended gallium source and gallium arsenide. (*See, e.g.*, paras. 19 and 20). The Office action assertions, therefore, are misplaced.

Further, King does not disclose or suggest “an extended gallium source partially inside and partially outside the reactor tube” as recited in claim 1. Rather, the limited description provided by King refers to a charge of gallium arsenide 15 and a charge of arsenic 16 inside of an ampoule 14. (*See, e.g.*, King, p. 2, col. 2, line 1 (“sealed ampoule 14 of 70cm length and 3 cm diameter”)). Thus, King actually discloses a configuration that is the opposite of that recited in claim 1.

King also fails to disclose or suggest “said extended gallium source being controllably positionable” as recited in claim 1. King refers to moving a charge, but does not disclose or suggest an extended gallium source configured as recited in claim 1 that is controllably positionable.

Further, King fails to disclose or suggest “said extended gallium source having a length so that different portions of said extended gallium source are maintained at different temperatures” and “so that said multi-zone heater maintains a first portion of said extended gallium source at a first temperature greater than 450°C. while simultaneously maintaining a second portion of said extended gallium source at a second temperature in the range of 30°C. to 100°C.” as recited in claim 1. As discussed above, King does not disclose or suggest a gallium source or an extended gallium source. Moreover, King does not disclose or suggest different portions of the extended gallium source being maintained at the recited temperature ranges.

Instead, King refers to temperatures of a charge of gallium arsenide (but not a gallium or extended gallium source) in a “hot” zone at temperatures of 1,238°C. and 1,250°C. (King, p. 2, col. 2, lines 84-89). This temperature range is only 12°C., which is in sharp contrast to claim 1, which refers to a first portion of an extended gallium source being maintained at a temperature greater than 450°C. while maintaining a second portion of that extended gallium source at a temperature between 30-100°C. This represents a minimum temperature difference of about 350-420°C. Otherwise, King refers to maintaining arsenic in a cool zone at a temperature of 610°C. (King, p. 2, col. 2, lines 83-94). More particularly, King states that arsenic in the cool zone must be maintained at 610°C. (King, p. 2., col. 2, line 95). As such, King cannot support the rejection given the description of different materials at different temperatures, and that certain temperatures “must” be maintained at a certain temperature. If the rejection stands, Applicants respectfully request the Examiner to specifically identify which component or charge described by King is relied upon to support the rejection.

Additionally, King fails to disclose or suggest “wherein upon reaction initiation said second portion at said second temperature comprises at least 50 percent of said extended gallium source” as recited in claim 1. Rather, the limited description provided by King explains that a charge can be moved. (King, p. 1, col. 1; p. 2, col. 2). The Office action, however, has not identified any section of King that actually discloses the “at least 50 percent” limitation.

Given these multiple deficiencies, the asserted combination of Yanashima and King does not result in all of the elements and limitations of claim 1 assuming *arguendo* that the combination were made. Thus, the rejection of claim 1 under §103(a) cannot be maintained. MPEP § 2143.03.

In addition, the rejection cannot stand for the additional reason that required suggestion or motivation to combine Yanashima and King and to make the requisite substantial changes that

would be required is clearly lacking. Yanashima describes a fixed system having a tube 111 that is physically divided into five parts by partition plates (col. 11, lines 10-12). A boat 136 containing Ga 135 is “put on the partition plate 113” between plates 113 and 114. In other words, the boat 136 “is set” on the plate 113 between plates 113 and 114. (col. 11, lines 42-43). King, on the other hand, describes moving a charge in a sealed envelope and maintaining a two-zone furnace system with a “hot zone” and a “cool zone” involving particular temperatures, as described above. However, in the configuration described by Yanashima, the boat 136 and Ga 135 do not move and are not adjustable, i.e., they are set on a plate, and the plates divide the tube into different areas into which different gases are supplied. Further, Yamashima and King refer to system configurations that use different temperatures (Yamashima, col. 12, lines 22-26); (King, p. 2., col. 2, lines 83-95). The required suggestion or motivation to combine the references is lacking given these different system configurations, and Applicants respectfully request that the rejection of independent 1 under 35 U.S.C. §103(a) be withdrawn.

Both references also teach away from claim 1, which recites “an extended gallium source at least partially inside and partially outside the reactor tube” since both Yanashima and King describe system in which materials are closed or sealed within a reactor. *See, e.g.*, King, p. 2, col. 2, lines 1-2 (“sealed ampoule”). Moreover, King teaches away “maintains a first portion of said extended gallium source at a first temperature greater than 450°C. while simultaneously maintaining a second portion of said extended gallium source at a second temperature in the range of 30°C. to 100°C.” as recited in claim 1 given the very limited temperature ranges of the “hot” zone (1,238°C - 1,250°C.) and King explicitly stating that arsenic in the “cool zone” must be maintained at 610°C. (King, p. 2, col. 2, line 95) (emphasis added).

Dependent claims 2-5, 7, 8, 12-14, 17, 18, 20, 24 and 25 incorporate all of the elements and limitations of independent claim 1 and add novel and non-obvious limitations thereto. Applicants respectfully submit that these dependent claims are also allowable in view of the amendments to claim 1 and the above remarks. MPEP §2143.03 (if an independent claim is non-obvious, then a claim that depends from the independent claim is also non-obvious). The cited references are also deficient relative to various dependent claims.

For example, Yanashima and King fail to disclose or suggest “said extended gallium source being controllably positionable so that upon reaction initiation said second portion comprises at least

90 percent of said extended gallium source” as recited in claim 2. King is silent as to this limitation. The limited disclosure of King refers to moving a charge.

Further, Yanashima and King fail to disclose or suggest “said extended gallium source being controllably positionable so that said second temperature is in the range of 30°C. to 40°C.” as recited in claim 3. King, for example, describes specific “hot” zone temperatures of 1,238°C. and 1,250°C., and that the “cool” zone temperature “must be maintained at 610°C.” all of which are temperatures much higher than “in the range of 30°C. to 40°C.” as recited in claim 3.

Yanashima and King also fail to disclose or suggest claims that recite a donor impurity source zone, wherein an acceptor impurity or a donor impurity are maintained at a third temperature, as recited in claims 7 and 8.

Further, neither reference discloses nor suggests the reactor “being configured for use with a modified hydride vapor phase epitaxial (HVPE) process” as recited in claim 14. For example, Yanashima only refers to MOCVD, MBE and HVPE. (Yanashima, col. 1, lines 59-60).

The cited references also fail to disclose or suggest “said extended gallium source being controllably positioned so that the extended gallium source is moveable into and out of the reactor tube” as recited in claim 20. Yanashima, for example, shows a tube 111 with walls that would preclude such a configuration. Further, King refers to a “sealed” ampoule, which would also preclude such movement. The Office action has not established the required suggestion or motivation for making these substantial changes, which would change the fundamental operation of a closed or sealed device. The mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination.

III. Claims 6 and 26 Are Patentable Over Yanashima In View of King and Jacob

Dependent claims 6 and 26 are rejected under 35 U.S.C. §103(a) as being unpatentable over Yanashima in view of King and further in view of U.S. Patent No. 4,268,842 to Jacob *et al.* (“Jacob”). The Office action relies on Jacob as disclosing a multi-zone heater. (Office action, p. 5).

Jacob, however, does not cure the deficiencies of Yanashima and King. Thus, assuming *arguendo* the asserted combination of the three references were made, the combination would nevertheless fail to disclose or suggest each limitation of independent claim 1 and dependent claims

6 and 26. Accordingly, Applicants respectfully request that the rejection of claims 6 and 26 under 35 U.S.C. §103(a) should be withdrawn. MPEP § 2143.03.

IV. Claims 9-11 and 23 Are Patentable Over Yanashima In View of King and Imaizumi

Dependent claims 9-11 and 23 are rejected under 35 U.S.C. §103(a) as being unpatentable over Yanashima in view of King and further in view of U.S. Patent No. 5,266,127 to Imaizumi (“Imaizumi”). The Office action relies on Imaizumi as disclosing a means for transferring a substrate.

Imaizumi, however, does not cure the deficiencies of Yanashima and King. Thus, assuming *arguendo* the asserted combination of the three references were made, the combination would nevertheless fail to disclose or suggest each limitation of dependent claims 9-11 and 23. Accordingly, the rejection under 35 U.S.C. §103(a) should be withdrawn. MPEP § 2143.03.

V. Claim 15 Is Patentable Over Yanashima In View of King and Konno

Dependent claim 15 is rejected under 35 U.S.C. §103(a) as being unpatentable over Yanashima in view of King and further in view of Japanese Patent No. 59229816 to Konno (“Konno”). The Office action relies on Konno as disclosing a control rod for manipulating the position of the gallium source.

Konno, however, does not cure the deficiencies of Yanashima and King. Thus, assuming *arguendo* the asserted combination of the three references were made, the combination would nevertheless fail to disclose or suggest each limitation of independent claim 1 and dependent claim 15. Accordingly, the rejection under 35 U.S.C. §103(a) should be withdrawn. MPEP § 2143.03.

Further, the required suggestion or motivation to combine Yanashima, King and Konno is lacking. As discussed above, Yanashima shows a tube 111 with walls that is physically divided into five parts by partition plates (col. 11, lines 10-12). A boat 136 containing Ga 135 is “put on the partition plate 113” between plates 113 and 114. In other words, the boat 136 “is set” on the plate 113 between plates 113 and 114. (col. 11, lines 42-43). The configuration described by Yanashima, the boat 136 and Ga 135 do not move and are not adjustable, i.e., they are set on a plate. Changing Yanashima as asserted by the Office action would require substantial modifications to the tube 111 that is divided into five parts by partition plates. The required suggestion or motivation to combine the references, therefore, is lacking. The mere fact that references can be combined or modified does

not render the resultant combination obvious unless the prior art also suggests the desirability of the combination. Applicants, therefore, respectfully request that the rejection of claim 15 under 35 U.S.C. §103(a) be withdrawn.

VI. Claim 21 Is Patentable Over Yanashima In View of King and Tanaka

Dependent claim 21 is rejected under 35 U.S.C. §103(a) as being unpatentable over Yanashima in view of King and further in view of U.S. Patent No. 5,223,305 to Tanaka ("Tanaka"). The Office action relies on Tanaka as disclosing use of an extended source tube for the purpose of providing a structure for introducing materials into a reactor.

Tanaka, however, does not cure the deficiencies of Yanashima and King. Thus, assuming *arguendo* the asserted combination of the three references were made, the combination would nevertheless fail to disclose or suggest each limitation of independent claim 1 and dependent claim 21. Accordingly, the rejection under 35 U.S.C. §103(a) should be withdrawn. MPEP § 2143.03.

VII. New Claims 27-31 Are Patentable

Applicants respectfully submit that new dependent claims 27-31 are also allowable in view of the deficiencies of the cited references and the above remarks.

VIII. Conclusion

In view of the above amendments and remarks, Applicants respectfully request that application is in condition for allowance. If there are any remaining issues that can be resolved by telephone, Applicants invite the Examiner to contact the undersigned at the number indicated below.

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